Excerpts Referenced in Vanston Surrebuttal Testimony

Transforming the Local Exchange Network:

Analyses and Forecasts of Technology Change

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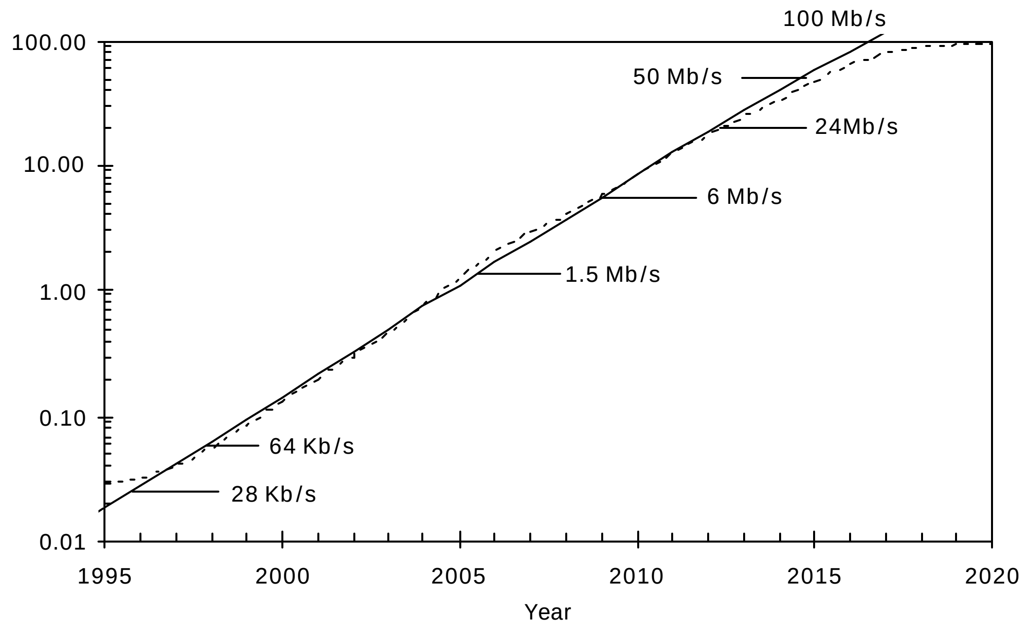
Exhibit 3.19
Home Digital Services—Average Data Rate



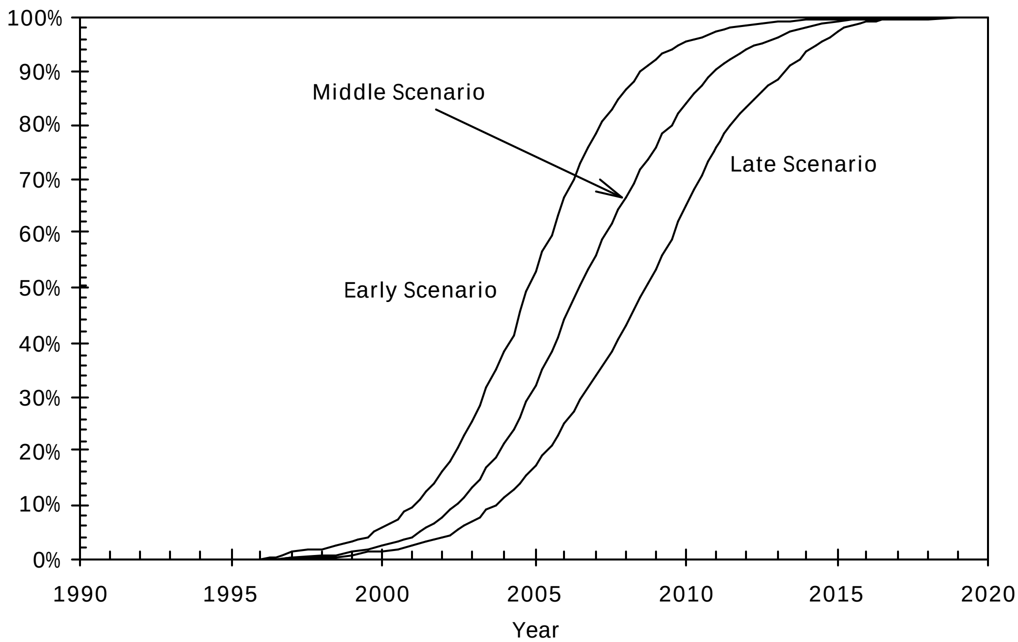
Source: Technology Futures, Inc.

Forecasts of the Adoption of Fiber-in-the-Loop for Multimedia On-line/Internet Services

As we have noted, FITL architectures provide an excellent vehicle for the provision of high-speed digital services, as well as offering intrinsic cost and operational advantages over its competitors, including xDSL copper cable. The advantage of xDSL lies in its applicability on existing copper cable rather than on any intrinsic operational or cost benefits. Thus, LECs have choices regarding fiber and xDSL that involve the balancing of short-term and long-term considerations. We developed three distribution fiber adoption scenarios based on the availability forecasts described above; each reflects a different LEC strategy. As noted earlier, the “Early Scenario” assumes no use of xDSL, the “Late Scenario” assumes maximum use, and the “Middle Scenario” assumes a transitional strategy over time between minimal and maximum use of xDSL.

The early scenario assumes that all high-speed digital services (1.5 Mb/s and above) are served on FITL systems. Thus, the percentage of households served on fiber is the same as the availability forecast for high-speed digital services. This forecast is shown by the left line in Exhibit 3.20. This scenario requires the transition of 80% of LEC copper distribution facilities to fiber by 2007.

Exhibit 3.20
Home Digital Service Availability on Fiber



Source: Technology Futures, Inc.

The late scenario assumes maximum use of xDSL, subject to the loop length limitations shown in Exhibit 3.18. The combination of the approximate distribution of loop lengths and the xDSL loop-length limitations imply that, under the late scenario, about 20% of 1.5 Mb/s subscribers, 50% of 6 Mb/s subscribers, and 87.5% of 24 Mb/s subscribers would need to be served on FITL; the remainder are assumed to be served on copper-based xDSL systems. [10] For 100 Mb/s, the late scenario assumes 100% FITL. Although, our nominal 100 Mb/s category includes 52 Mb/s xDSL, with a maximum length of 1,000 feet on copper, xDSL at this rate qualifies under our definition of FITL. Further, because of the topology of the distribution network, the average length of copper will likely be much less—in some cases, the distance from the pedestal to the home. Finally, as data rates of 100 Mb/s or above become representative of this category, xDSL applicability will be further decreased.

The late scenario is indicated by the right-hand line in Exhibit 3.20. It was derived by taking the weighted average of the above FITL percentages for each year, weighted by the percentage of households demanding each nominal data rate as shown in Exhibit 3.18. The late scenario requires that telephone companies convert about 35% of their distribution network to fiber by 2007, about half of what is required under the early scenario.

The middle scenario assumes a mixed strategy that most resembles the late scenario in the early years and the early scenario in the later years. This maximizes the value of xDSL in providing service to customers, but allows LECs to avoid massive fiber infrastructure investments when penetration levels are relatively low. It maximizes the value of fiber later when penetration levels make such fiber infrastructure investments easier to justify. This principle is implemented in the derivation of the middle scenario by calculating a weighted average of the early and middle scenarios, with weights of 20% and 80%, respectively, in 1999, transitioning to equal weights in 2005, and weights of 80% and 20%, respectively, in 2015. As shown by the middle line in Exhibit 3.20, this scenario requires LECs to convert 56% of their distribution copper to fiber by 2007.

Forecasts for the Adoption of xDSL

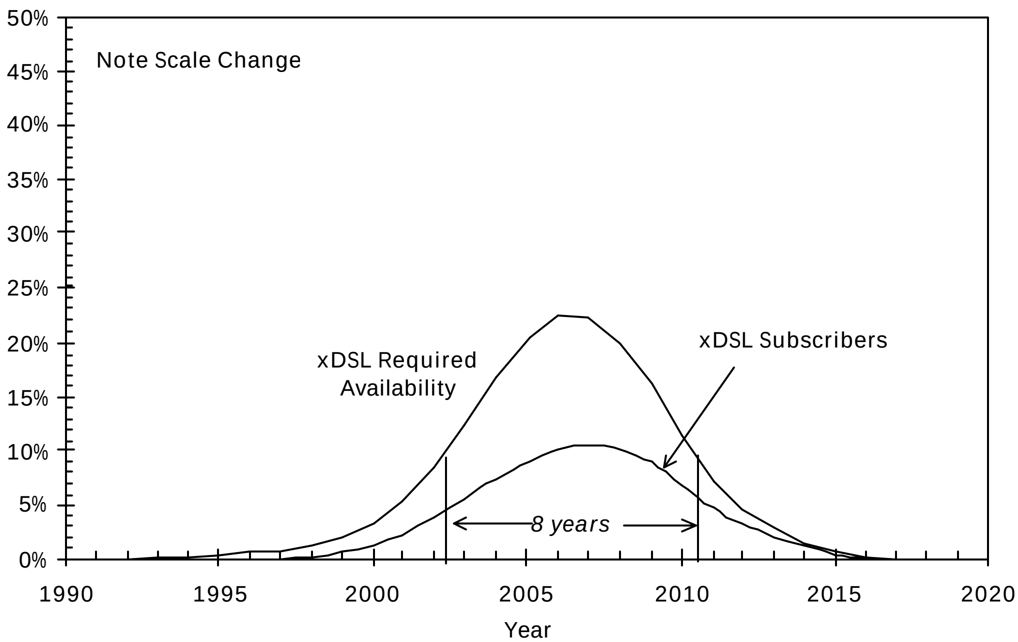
The middle and late scenarios for FITL adoption assume significant deployment of xDSL technology to serve multimedia on-line/Internet services demand.

[10] This interpretation assumes that customers are served by xDSL directly from the central office. An alternative is to connect distant customers to remote terminals that bring the xDSL electronics closer to the customer. Since these will have to be brought closer and closer as data rates increase, more and more copper will be displaced by fiber. For companies that choose to implement xDSL this way, the forecasts can be reinterpreted as the proportional impact on copper investment. In other words, suppose that 6 Mb/s service is required for 20% of households. Under the first interpretation, 10% of households would be served by 6 Mb/s xDSL (50% of 20%); in the second interpretation, 20% of households would be served by 6 Mb/s xDSL, but the average length of the copper distribution cable would be 50% of its previous length.

Exhibits 3.21 and 3.22 show the percentage of households that will be served by xDSL, as well as required availability. For the middle scenario, peak xDSL deployment occurs in 2007 when the access lines for 20% of households would need to be xDSL-ready and about half of these would need to be provisioned with xDSL equipment. For the late scenario, the peak occurs at about the same time, but 45% of access lines would have to be xDSL-ready and 20% would have to be provisioned.

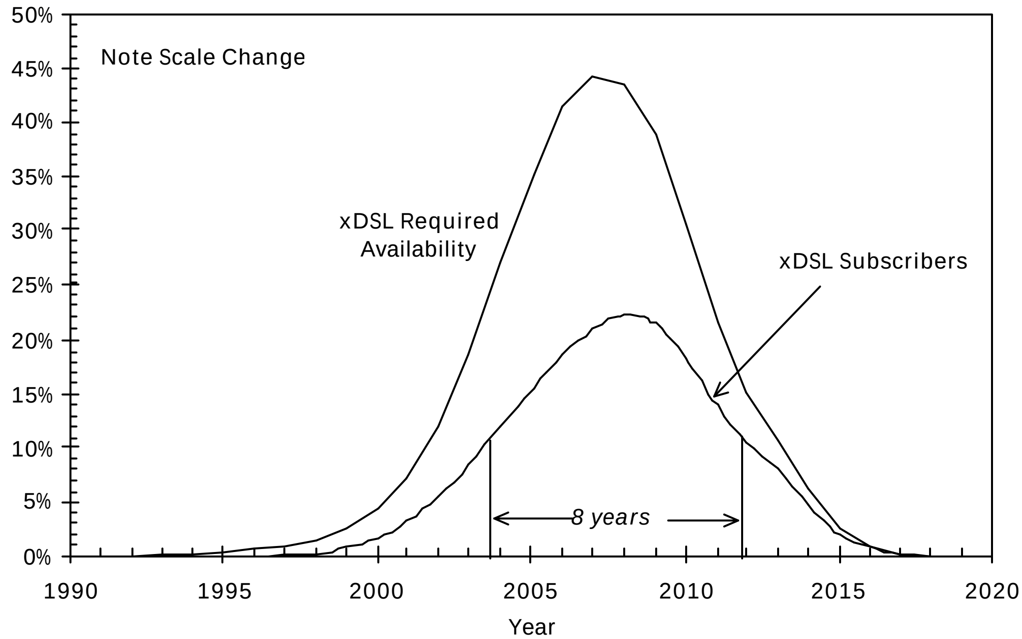
Exhibit 3.21

xDSL Households—Middle Scenario



Source: Technology Futures, Inc.

Exhibit 3.22
xDSL Households—Late Scenario



Source: Technology Futures, Inc.

Relative Likelihood and Desirability of Home FITL Scenarios

As we have discussed, the choice among the three scenarios boils down to the strategic role of xDSL. Referring back to Exhibits 3.21 and 3.22, it is not clear whether for either the middle or late scenarios there is sufficient time to fully recover the investment in xDSL technology before the ultimate adoption of fiber. For either scenario, the average xDSL investment will be placed in 2003 or 2004 and retired in 2011 or 2012, leading to an eight-year average service life for xDSL as a class. Although eight years is consistent with TFI's recomendations for digital circuit equipment, the actual life may be somewhat less given the need to transition from one xDSL speed to the next. Also, deploying xDSL often requires significant rehabilitation of existing copper facilities, and assumed service lives for outside plant generally exceed eight years.

Although these concerns are not particularly important for xDSL equipment placed in the next five years or so, they become quite important for equipment placed thereafter. In the late scenario, over 15% of access lines would be provisioned with xDSL between 2002 and 2007, while in the middle scenario about 5% would be provisioned in the same period. During this period, high-speed digital subscribership will likely increase from under 10% of households to about 40%—subscribership levels where FITL-based systems prove-in and will provide competitive advantages to those companies deploying them. Thus, the wisdom of deploying a soon-to-be obsolete technology at the levels implied by the late scenario during the 2002-2007 period is very questionable. Put another way, if LECs follow the late scenario, they will place massive investments in upgrading to xDSL only to find, in 2007, that they are competing in a fiber world with a distribution network that is still 70% copper. For this reason, we believe the middle scenario is more likely and desirable than the late scenario for companies that pursue an xDSL-oriented strategy.

With the inherent difficulties of managing the distance limitations of xDSL in an environment where the minimum competitive bandwidth is doubling every two years, some companies will decide to minimize their use of copper-based xDSL and adopt FITL according to the early scenario. Properly engineered, FITL provides sufficient bandwidth (or potential bandwidth) to meet the projected requirements for several decades. Further, companies following the early scenario will obtain the other benefits of FITL sooner. The main problem with the early scenario is uncertainty about which FITL architecture is best. As noted previously, consensus is still several years away. The solution is to adopt flexible architectures that can be migrated or upgraded as future developments warrant.

Finally, some companies are facing early competiton from cable voice or have aggressive strategies regarding video opportunities. These companies may follow a path of FITL adoption that is more aggressive than the early scenario. They are adopting architectures and operating systems that will enable them to provide any type of service, including voice, efficiently. To the extent that the architecture they select is flexible and upgradable, this will pre-position these companies to respond to competition or take early advantage of the opportunities afforded by offering integrated packages of services.

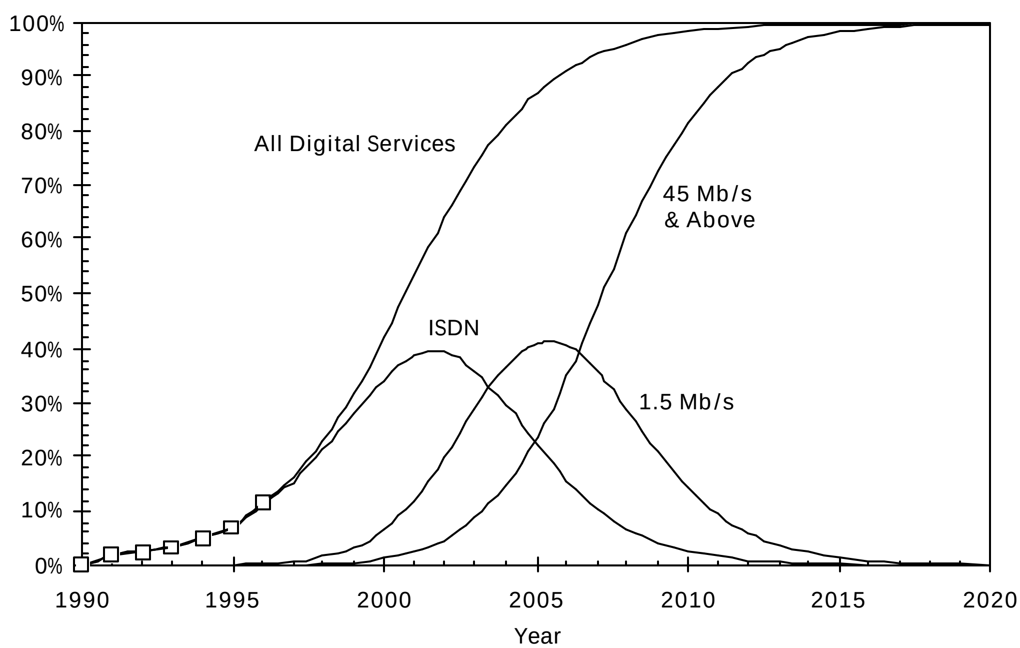
Based on the above discussion, we believe that *most* LECs will follow a path of FITL adoption between the early and middle scenarios. These companies will make some use of copper-based xDSL, but not to the extent that would overcommit them to an obsolete copper network over the long run. Based on any number of factors—including competitive pressures, demographics, geography, mix of aerial and buried cable, corporate culture, regulatory environment, and growth—some companies will adopt FITL earlier or later.

Small Business Location Services

ISDN has been the main digital service available to small business locations, and, recently, adoption has been rapid with 760,000 lines in service at the end of 1996. With 6.5 million small business locations, penetration has surpassed 10%. Adoption has followed the Fisher-Pry model with an **r** value of 56%. We use the projection of the historical pattern of ISDN adoption as our forecast for the adoption of all digital services at small business locations, as shown by the left-most line in Exhibit 3.23. For the next several years, these digital services will be represented primarily by ISDN, with faster services becoming prevalent in a few years as will be discussed next.

Exhibit 3.23

Digital Subscribers—Small Business Locations



Source: Technology Futures, Inc.

Exhibit E.5
Home Digital Service Availability on Fiber

Fiber vs. xDSL Assumptions

Scenario	Pct of Homes or Distance on Fiber				
	ISDN	1.5 Mb/s	6 Mb/s	24 Mb/s	100 Mb/s>
Early	0.0%	100.0%	100.0%	100.0%	100.0%
Late	0.0%	20.0%	50.0%	87.5%	100.0%
Middle			Transition		

1	*2*	*3*	*4*	*5*
		Digital Service Availability on Fiber *Pct of Access Lines or Distance*		
Year	Total Households *(Millions)*	Early Scenario	Middle Scenario	Late Scenario
1996	109.11	0.0%	0.0%	0.0%
1997	110.52	1.0%	0.3%	0.2%
1998	112.09	1.8%	0.6%	0.4%
1999	113.86	3.2%	1.2%	0.7%
2000	115.80	5.6%	2.3%	1.3%
2001	117.94	9.6%	4.3%	2.3%
2002	120.31	16.0%	7.7%	4.1%
2003	122.93	25.6%	13.2%	6.9%
2004	125.81	38.2%	21.4%	11.2%
2005	128.94	52.7%	32.1%	17.4%
2006	132.31	66.7%	44.2%	25.2%
2007	135.93	78.3%	56.2%	34.0%
2008	139.76	86.7%	66.7%	43.2%
2009	143.78	92.1%	75.9%	53.2%
2010	147.97	95.5%	84.0%	65.0%
2011	152.29	97.4%	90.2%	75.9%
2012	156.68	98.6%	94.0%	83.4%
2013	161.05	99.2%	96.4%	88.5%
2014	165.37	99.6%	98.2%	93.5%
2015	169.56	99.8%	99.3%	97.3%
2016	173.56	99.9%	99.8%	99.1%
2017	177.32	100.0%	99.9%	99.7%
2018	180.78	100.0%	100.0%	99.9%
2019	183.92	100.0%	100.0%	100.0%
2020	186.69	100.0%	100.0%	100.0%

Source: Technology Futures, Inc.

Column 4 of Exhibit E.5 shows the results for the middle scenario. For each year, it is the weighted average of the early and late scenarios, with the relative weight changing by year. As noted, the weighting favors xDSL in the early years and fiber in the later years. Exhibit E.7 shows the weights that were used for each year. We assumed that, in 2007, the xDSL-intensive and fiber-intensive strategies will be equally weighted and that, in 2020, the fiber-intensive strategy has a 90%

Exhibit 1.16

TFI 1997 Recommendations for Equipment Lives

Technology	Average Remaining Life (1/1/97)	Projection Life—New Investment	Projection Life—Existing Investment
Outside Plant			
Copper Cable			
Interoffice	2.8	3	8-10
Feeder	7.2	7	15-17
Distribution			
Early Scenario	8.1	10	14-18
Middle Scenario	9.8	12	15-20
Late Scenario	11.5	14	17-23
TFI Recommended	**8-10**	**10-12**	**14-20**
Fiber Cable			
All Categories	12-16	20	20
Circuit Equipment			
Analog	2.1	---	---
Non-SONET (Digital)	3.6	4	6 - 9
SONET	5 - 8	8	8
Switching			
Analog	2.1	---	---
Digital	6.3	8	9 - 12

Notes:

(1) These are estimates for the industry; some companies may have lower or higher lives, depending on various factors.
(2) The lives do not reflect economic impacts on prices and market shares due to competition.
(3) For most categories, the projection life for the installed base is computed from the remaining life and depends on the particular distribution of plant a company has. For Fiber and SONET, the remaining life is computed from the recommended projection life, and depends on the plant distribution as well. The ranges are for typical plant distributions; some companies may have values that fall outside the range.
(4) Average Remaining Lives are not ELG-weighted.

Source: Technology Futures, Inc.